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Tradition or transformation? An evaluation of ICTs in Metro Manila schools

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Abstract. Information and communication technologies (ICTs) usage in education falls into three board categories: ICTs as objects under study, ICTs as support tools, and ICTs as catalysts for transformation. The researcher's goal was to determine and evaluate the status of ICT resources in Metro Manila schools. Specifically, the researcher wanted to determine the goals that educators had for using ICTs, whether schools had the necessary ICT facilities to reach these goals, whether actual usage was consistent with these goals, and whether there were differences between public and private schools' responses. Using a mail-in questionnaire and follow-up interviews, the researcher determined that schools, a few primary schools and many secondary schools said they espoused emerging or transformative uses of ICTs. However, Metro Manila students' access to computers, peripherals, and the Internet was poor. Software selections were also generally limited to productivity tools. As such, ICTs were actually primarily used to teach computer literacy and programming. Private schools were better equipped than public schools, but ICT usage was similarly limited.

Keywords: International education, information and communication technologies, developing countries, Philippines, primary school, secondary school

1. Introduction

Information and communication technology (ICT) usage in education falls into three broad categories: ICTs as objects under study, ICTs as support tools, and ICTs as catalysts for transformation. When ICTs are the objects under study, these technologies are the subject matter in themselves. Students learn the history and parts of the computer, how to program, how to navigate around a graphical user interface, etc. The goal of this approach is for students to develop mastery over technology [10].

When ICTs are used as productity tools or enrichment resources, this generally means that they support the traditional teacher-led mode of instruction in subject areas such as math, language, social studies, or science. Teachers show slides using digital projectors and record grades on spreadsheets while students write reports on word processors. Computers become better typewriters, calculators, and grade books [3]. Teachers may also use tutorials and drills to develop students' familiarity with and fluency in a subject [34].

Transformative applications of ICTs refer to non-traditional emerging uses where exposure to and deployment of ICTs fundamentally change the way education is conceived and delivered to students. ICTs are enablers that optimize student-centered pedagogical methods. They are used to develop broad, generic skills such as problem solving, independent and collaborative learning, and communication [10]. They lead to more individualized instruction, less didactic delivery, and an emphasis on problem-solving

and cooperative learning situations [12]. Teachers assume the role of facilitators and skills developers. They help the students achieve a greater understanding of information by making use of new technologies.

These three categories are not mutually-exclusive. However the most dramatic changes to teaching and learning occur when the third approach is employed.

2. Context

The government and private sector of the Philippines have invested in information and communication technologies (ICTs) as tools to transform teaching and learning. In 1996, the Philippines' Department of Education, Culture, and Sports (now Department of Education or DepEd) initiated a P375 million modernization program for the benefit of Philippine secondary schools. In May 1997, a nationwide program to computerize 97 state colleges and universities and 168 private schools was launched with a budget of P300 million [30]. By 2009, the DepEd plans to equip all public secondary schools with appropriate educational technology equipment, to supply 75% of public secondary schools with multimedia-capable computer laboratories, to train 75% of teachers in the use of the Internet and computer-aided instruction, and and to integrate all learning areas of the curriculum with ICTs where appropriate [1].

The private sector has also endeavored to infuse schools with ICTs. Sixty-eight percent of private schools with computers acquired their machines though outright purchase [14]. Others obtained their equipment through leases and donations. For example, in February 1999, Citibank, N.A.-Philippines granted US$100,000 to establish computer laboratories in secondary schools [18]. By July 1999, Citibank and its implementing arm, PBSP, constructed computer laboratories in four high schools around the Metro Manila area.

However, investment in ICTs has been controversial. The Philippines' educational system is fraught with problems and limitations typical of the Third World. Schools lack chairs and tables, blackboards, and laboratory equipment [28]. Some do not have electricity and water [5]. Members of the Philippine legislature have therefore questioned the logic behind appropriating funds for computers but not for cheaper educational tools such as globes and microscopes [28].

3. Statement of the problem

There is a need for quantitative data regarding the status of ICTs in Metro Manila schools. At present, there is little data about how schools worldwide are using their ICT resources [13]. The emergence of ICTs in education has happened so quickly that the extent to which technology has actually infused schools is not known [17]. In the Philippines, neither the executive nor the legislative branches of the government know whether existing computers in schools are being used for educational computing [28]. Whether computers in schools are, in fact, being fully utilized for educational computing is therefore uncertain [34]. Some congressmen have even aired concerns that computers meant for students were instead being used only by teachers for preparing lesson plans or playing games [29]. Indeed, the extent to which Philippine public and private schools are using IT is largely unknown.

4. Goal and research questions

The researcher's goal was to ascertain and evaluate the status of ICTs in Metro Manila public and private schools. Research questions were as follows:

1. What are educators' goals for using ICTs?
2. Do schools have the necessary hardware, software, and connectivity to reach those goals?
3. Are schools using their ICT resources in ways that are consistent with those goals?
4. How do public and private schools compare?

The researcher then determined under which of the three categories these uses and goals fell: ICTs as subject matter, ICTs as support tools, or ICTs as catalysts for transformation.

5. Hypothesis

The researcher hypothesized that ICTs in Metro Manila public and private schools were used primarily to teach computer literacy. When used in conjunction with other subjects, these resources were still being used following traditional rather than emerging approaches.

6. Significance

It is imperative to gather data regarding the use of ICTs in Philippine schools in order to determine ICTs are indeed helping schools achieve the gains that educators and policy makers hoped they would. A quantitative study of the extent of ICT usage may help determine whether or not technology meets or falls short of specific organizational goals [7]. The 1998 progress report on the 1996 DECS acknowledged completion of most hardware deliveries, but it also cited shortcomings: there was a lack of congruence between approved textbooks in educational computing and teacher training; teacher and administrator training concentrated on specific technologies and applications rather than in more general competencies; and there was a one year time lag between the training and the delivery of the hardware [35]. These shortcomings raised doubts about whether the delivered computers were in fact being fully utilized for educational computing.

Documentation also provides a rationale both for or against project continuation or replication. The Philippine government's Educational Technology Master Plan [26] underscores the importance of studying and observing best practices of educational institutions in the Philippines and abroad for possible replication in the public school sector. Conversely, failure to document "return on investment" may result in a backlash against educational technology that may be difficult to overcome [16]. For example, the Philippine national legislature refused to fund the DepEd's computerization program after the initial release of funds. Gonzales [6] suspected that legislators were uncertain of DECS's ability to mount, evaluate, and sustain the ICT program.

7. Limitations and delimitations

The Philippines is an archipelago with over 7,000 islands grouped into 16 regions. The study's geographic scope was limited to the National Capital Region (NCR), also known as Metro Manila. At the time the researcher conducted this study, Metro Manila had a population of 10 million or 14% of the nation's 70 million total [31]. It had approximately 1,000 elementary schools and 550 secondary schools, public and private [19–21]. As of school year 2000-2001, there were 1,387,833 students enrolled in elementary schools and 2,212,557 in secondary [23]. Metro Manila had a literacy rate of 98.1%, the highest in the country [31].

While Metro Manila was not representative of the Philippines, it was the area under study because it had the Philippines' highest concentration of ICTs-related resources. A survey conducted by Philippines Department of Education, Culture, and Sports and the Philippines National Statistics Office [24] showed that 4.1% of households in Metro Manila have computers, while other regions registered proportions ranging from 0.2% to 1.6%. As of 2000, 54 out of 130 or 42% of Metro Manila public high schools had computers while concentrations of computers in other regions' public high schools ranged from 24% to 34% [22]. Of the 140 Internet Service Providers (ISPs) in the country at the time, 133 were based in Metro Manila [33] Finally, there was one telephone line for every three people in Metro Manila [32]. The national ratio was 1:11, varying from 1:11 to 1:65, depending on the region. It should also be noted that the NCR was considered the premier region in the Philippines, setting the national standard for, among other things, educational innovation [27]. A study confined to Metro Manila therefore provided an upper limit to ICTs usage in the Philippines as a whole and possibly developing countries in general.

A further constraint of this study was that it did not include an examination of information technology's impact on student achievement. Previous surveys [14,36] indicated that many Filipino schools used ICTs to teach computer literacy and that ICTs was still not integrated into subject matter areas. As such, an assessment of the impact of information technology on student achievement would have been premature. Finally, the researcher did not examine teacher training, administrative uses of computing, and attitudes towards technology.

8. Review of literature

In his book, Oversold and Underused: Computers in the Classroom, Larry Cuban [4] lamented that the overwhelming majority of teachers used information technology (IT) to sustain existing patterns of education, rather than to innovate. He writes that:

> Although promoters of new technologies often spout the rhetoric of fundamental change, few have pursued deep and comprehensive changes in the existing system of schooling. ... The introduction of information technologies into schools over the past two decades has achieved neither the transformation of teaching and learning nor the productivity gains that a reform coalition ... [has] sought ... I have concluded that computers in [the] classroom have been oversold by promoters and policymakers and underused by teachers and students.

When innovations of any kind are introduced to educators, most teachers adapt them to fit their customary teacher-centered practices [4]. A study by the US Office of Technology Assessment found that most teachers who use technologies do to develop students' computer-specific skills such as word processing [15]. The development of higher-ordered mathematical, problem-solving or reasoning skills are rare. Rather than revolutionizing education, these innovations perpetuate traditional teaching methods. Thus, the educational reforms that businessmen, educators, public officials, and parents seek are unachieved. Increased productivity, higher student achievement, and the transformation of learning remain unrealized. In Cuban's view, the billions of dollars invested in IT have yet to produce commensurate outcomes.

There is evidence to support Cuban's view. A study by the US Department of Education's National Center for Education Statistics [37] found that sixty-one percent of teachers assigned students word processing or spreadsheet work, while 50% of teachers gave problem solving and data analysis assignments.

Another study by Becker et al. [2] found that 71% of American teachers assigned computer work to students at least occasionally. Only one-third did so on a regular basis. Elementary teachers and

teachers of English, computer, business, and vocational classes were more likely to use computers on a regular basis than teachers of other subjects. The researchers found that, although skill practice using computers was on the decline, elementary teachers still used computers for drills. They found that 50% of teachers surveyed had their students use word processors, 36% used CD-ROM reference software, and 30% required their students to use the Internet.

Mathematics, computer, and business teachers reported more traditional objectives for using computers – mastering subject matter skills and computer proficiency. These teachers tended to use a narrow range of software packages and were unlikely to have students use computers outside of class. Teachers of other subject areas, though, reported more extensive educational goals. Social science teachers were interested in students finding out about new ideas and information. English and elementary teachers were interested in students' written expression. These teachers were likely to have students use a variety of software tools and packages. They were also likely to require students to use computers outside of regular class hours [2].

In Asia, Jo [11] reported that schools had from 25 to 32 IBM PC XTs or IBM compatible-machines without hard disks. Neither the quality nor the quantity of computers was satisfactory, given the average of 60 students per class. Thirty percent of those surveyed had no instructional software, despite the Korean government's support for the development and distribution of instructional programs. Elementary schools tended to have more software than secondary or tertiary level schools. About one-half of those surveyed identified computer literacy (teaching about computers) as the most important educational goal. Finally, the lack of teacher training was the primary hindrance to the instructional use of computers.

In the Philippines, evidence indicates that Cuban's observations also hold true. Studies have found that ICT usage is still limited to computer literacy training. Andrada and Abcede [1] of the DepEd state that private school students generally begin using computers in the second grade. They learning about the history, parts, and functions of the computer, then move on to keyboarding, simple word processing, and file management. By the high school level, they become proficient in using office productivity tools. In some cases, they learn to develop web sites development. The authors admit, though, that there is still limited application of ICTs in other learning areas. ICTs are used as openers or motivators, to collect information from web sites, or as productivity tools to produce reports and other outputs. ICTs are supplementary to instruction, rather than an integrated part of it.

A nationwide study conducted by the DOST's Science Education Institute [25] found that 50% of computers in schools were being used computer literacy. Only 11% of computers were used for science education and only 9% were used for mathematics.

9. Methodology

The researcher used a combination of mail-in survey questionnaires, follow-up telephone interviews, and on-site visits to gather data for this study.

9.1. Selection of subjects

The population under study consisted of public and private primary and secondary schools within Metro Manila. Twenty percent of grade schools and high schools were sampled for the mail-in questionnaire, while 5% of the 20% were sampled for the case studies.

The researcher first stratified the population by grade level (primary or secondary), then city or municipality, and then by ownership (public or private). The researcher used Microsoft® Excel's data

analysis tool to perform random selections from each subgroup the schools to whom the questionnaires were mailed. It was necessary to call each school to verify the name of its principal and its contact number. Schools that could not be contacted were substituted with other members from the same subgroup.

9.2. Construction of questionnaire

The researcher based her questionnaires, with permission, on the IEA [8,9] instruments. Following the IEA's model, the researcher drafted separate mail-in questionnaires for the principals and the computer coordinators.

The questionnaire addressed to school principals was concerned with schools' history of ICT use as well as related instructional and infrastructure goals. The computer coordinator questionnaire was of a more technical nature and was addressed to technical respondents, that is, faculty or staff members of the school who were familiar with the school's IT resources and their usage. The questionnaire gathered data regarding schools'.

9.3. Data gathering

The researcher sent the mail-in questionnaire with a cover letter to the select schools using a private courier service. When the respondents completed the survey questionnaires, they were instructed to call the researcher to arrange for pick-up. A private courier service was again contracted to pick up the completed questionnaires.

A second mail-out was necessary in instances when schools said the addressee was no longer connected with the school, when the principal had since been changed, or when schools claimed they never received the survey packet. Whenever these cases arose, the researcher resent the cover letter and questionnaires with the necessary changes. The survey packet was resent to 83 schools in all: 57 primary and 26 secondary.

9.4. Encoding and follow-up interviews

The researcher encoded responses as she received them. In many cases, the researcher had to call the respondents to verify contradictory or inconsistent information. Some schools said that they had, for example, 19 computers for student use but later accounted for 21 computers distributed throughout various locations. One computer coordinator claimed that they had no Internet access for student use, but the principal of the same school said that the school had been using the Internet for teaching and learning for the last three to five years. The researcher, therefore, had to contact the respondents by telephone to resolve these inconsistencies.

Although not all principals or computer coordinators were reachable, the telephone interviews enabled the researcher to correct erroneous data or complete missing data. Some interviewees also provided the researcher with additional information about their IT-related situations or problems.

9.5. Reporting of results

Results of the study will be grouped into two broad categories: Curriculum and Pedagogy, and Infrastructure. Curriculum and Pedagogy include policy goals, curricular goals, and learning outcomes. Infrastructure includes hardware, software, connectivity, and ICT uses for instruction. The researcher will supplement the quantitative data with anecdotal information gleaned from the follow-up interviews.

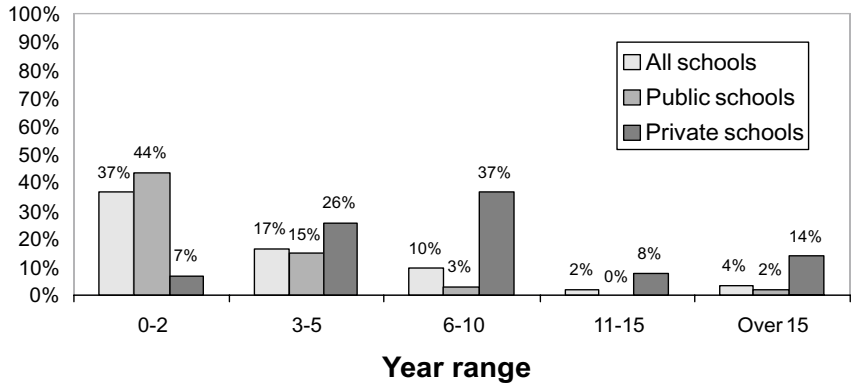

Fig. 1. Percentages of primary school students whose schools have been using ICTs for teaching and learning for the indicated number of years. Note: Percentages do not total to 100% because of non-response.

The researcher will also relate respondent data with the three categories of ICT usage discussed in the earlier sections of the paper.

The statistics to be reported will be proportional to the distribution of the students in the population. That is, a response from a school with a greater population will have more weight than a response from a school with few students. Percentages in the results shall not indicate the percentage of schools that gave a particular answer. Rather, they indicate the percentage of students whose principals or computer coordinators gave a particular response.

10. Profile of respondents

Of the 224 primary schools surveyed, the officials of 153 or 68% responded, 79 public schools and 74 private schools. These officials represented 226,434 elementary students or 181,552 and 44,882 public and private primary school students, respectively.

ICTs usage in Metro Manila primary schools was still in its infancy. Figure 1 shows that 37% of primary school students attended schools that had been using ICTs for teaching and learning for two years or less. Seventeen percent were in schools that had been using ICTs for three to five years. Ten percent were enrolled in schools that had been using ICTs for six to ten years. The principals of approximately 25% of all primary school students from reporting institutions indicated that the question did not apply to them because they did not have computers in their schools.

Private schools had more experience with using ICTs for teaching and learning than public schools. Figure 1 shows that the schools of 37% of private primary school students had six to 10 years experience using ICTs. Forty-four percent of public primary school students, on the other hand, came from schools that had been using ICTs for two years or less (Fig. 1).

With regards to secondary schools, 61 out of 110 or 55% responded to the survey, 24 public schools and 37 private schools. These responses represented 114,646 students, 92,232 from public schools and 21,204 from private schools. Practically all secondary schools surveyed offered all four levels of high school and were using ICTs for teaching and learning. Secondary schools have been using ICTs for teaching and learning for the medium- to long-term. Figure 2 shows that 40% of students were enrolled at high schools that had been using ICTs for up to five years. Thirty-seven percent, on the other hand, were enrolled at schools that had been using ICTs for six to 10 years. Eleven percent of students were

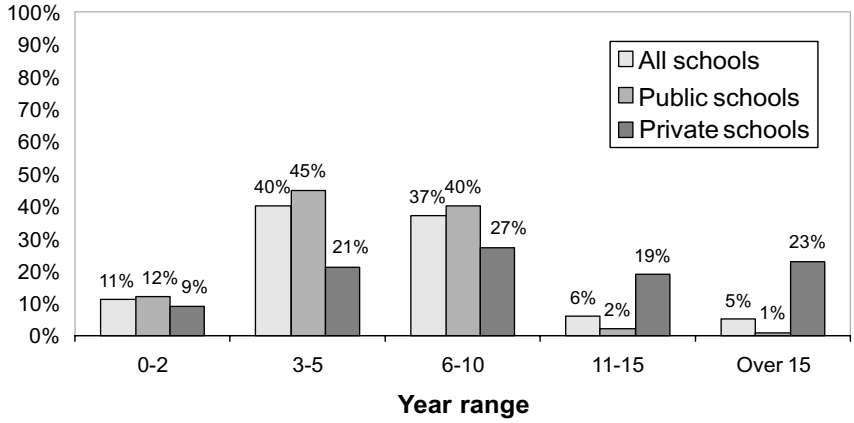

Fig. 2. Percentage of secondary school students whose schools have been using ICTs for teaching and learning for the indicated number of years. Note: Percentages do not total to 100% because of non-response.

enrolled at schools that had been using ICTs for two years or less. Students of the sample from schools using ICTs for 11 to 15 years and over 15 years accounted for 6% and 5% respectively.

Like their primary school counterparts, private secondary schools have a longer history of ICTs use than public secondary schools. Figure 2 shows that the 23% of private secondary school students came from schools that had been using ICTs for over 15 years, while 19% came from schools using ICTs for 11 to 15 years. Most public secondary school students sampled had been using ICTs for 10 years or less. Private schools students also tended to use ICTs earlier than public school students.

11. Curriculum and pedagogy

Schools use ICTs to achieve a variety of educational goals. These goals vary depending on the country, the level of education, and school ownership. At the grade school level, relatively few respondents prioritized emerging or transformative uses of ICTs. The principals of less than one-half of primary school students considered the the implementation of active learning strategies, and the individualizing of learning experiences and the development of independent learning as very important factors in determining ICTs use (Fig. 3). Cooperative learning and drill and practice were not very important goals in determining ICTs use in primary schools and the principals of only 27% of students considered "to make the learning process more interesting" a very important use of ICTs.

Private school principals had stronger sentiments their public school counterparts regarding the importance of emerging uses of ICTs (Fig. 3). Many gave high importance to the improvement of student achievement and the use of active learning strategies. The researcher attributed this difference in goals to the public schools' lack of facilities. Indeed, during the interviews, some public primary school principals asked whether the researcher was presenting a hypothetical or ideal situation. They also tended to preface their answers with, "Assuming we had computers . . . "

Secondary school gave more importance to emerging uses than elementary schools. Seventy-five to 83% of Metro Manila secondary school students are enrolled in schools that use ICTs to improve student achievement, promote active learning, develop independent learning, give drill and practice exercises, and make learning more interesting (Fig. 4).

Figure 4 also shows that principals representing a greater percentage of private secondary school students strongly believed in using ICTs to develop cooperative learning. More public secondary schools

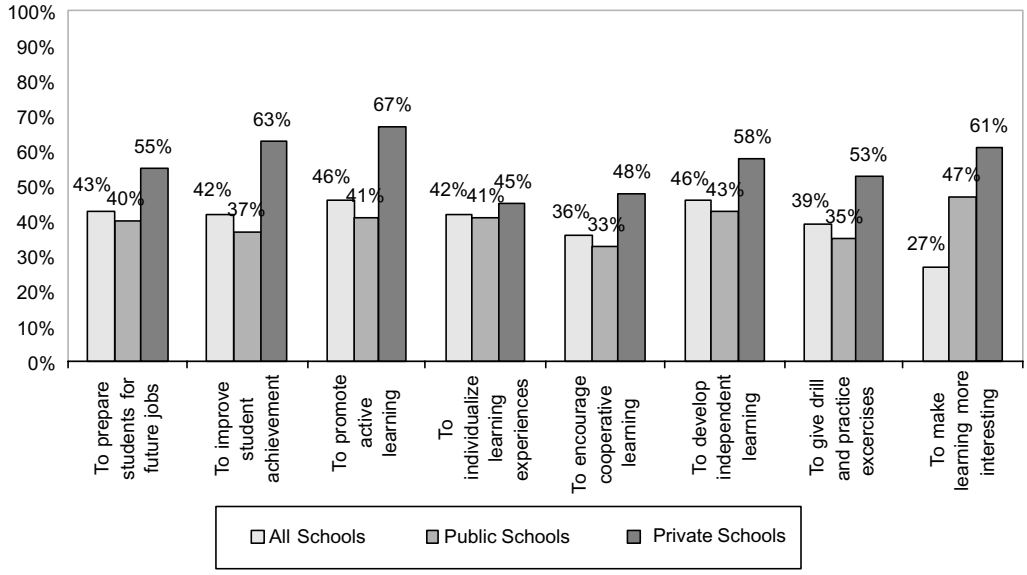

Fig. 3. Percentages of primary schools students whose principals indicated that particular goals were very important in determining the use of ICTs in their schools.

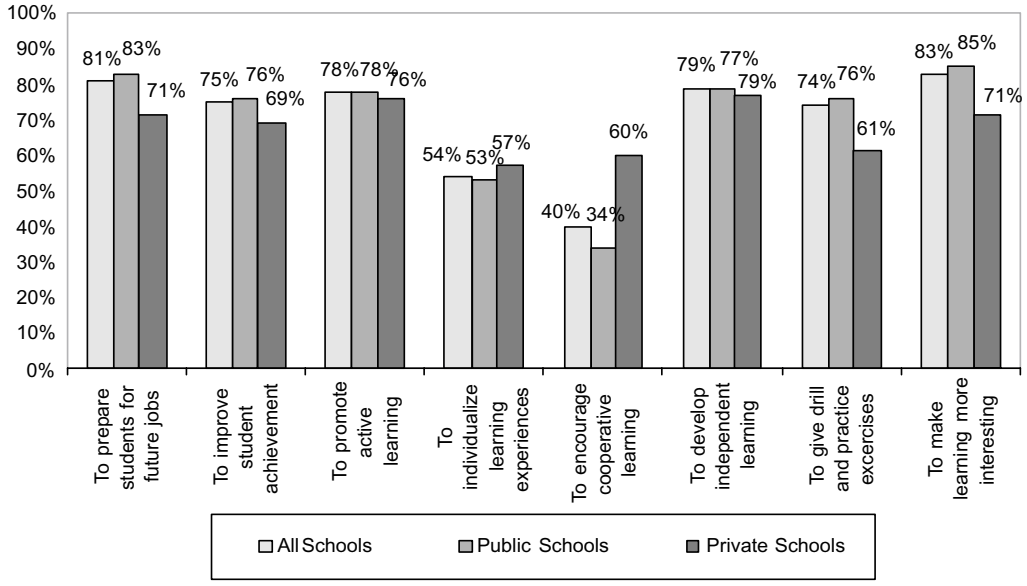

Fig. 4. Percentages of secondary schools students whose principals indicated that particular goals were very important in determining the use of ICTs in their schools.

tended to use ICTs to improve student achievement, to administer drill and practice exercises, and to make learning more interesting.

Figure 5 indicates the percentage of primary school students from Metro Manila whose principals responded that certain policy goals were present in their schools. Metro Manila primary school principals could not commit to providing computers in classrooms. Upon being interviewed, some principals said

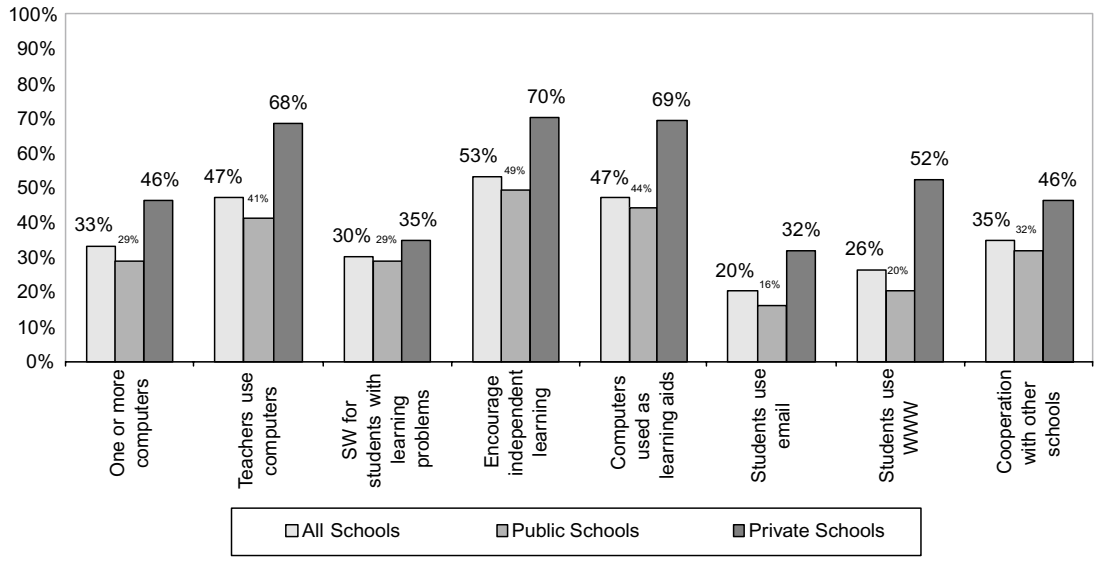

Fig. 5. Percent of primary school students whose principals indicated that certain policy goals were present.

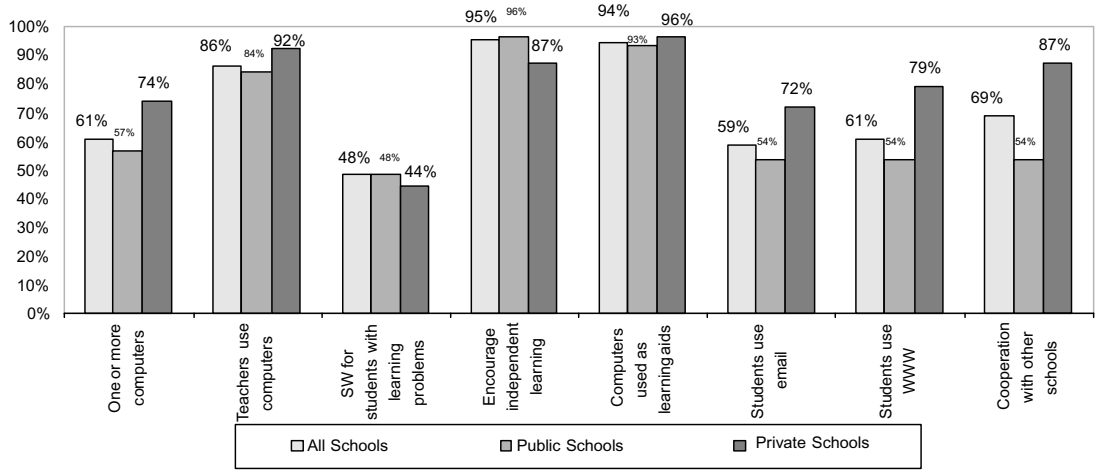

Fig. 6. Percent of secondary school students whose principals indicated that certain policy goals were present.

this goal was "more of a dream" because financial constraints prevented them from realistically adoping this as a policy. Lack of facilities or funding may account for the relatively low adoption of Internet-related policy goals (e.g. the use of email and the WWW), goals to encourage independent learning, and goals to use ICTs as teaching aids.

Unlike primary schools, secondary schools tended to espouse emerging uses of ICTs. Figure 6 ndicates that secondary schools encourage teachers to use ICTs for instruction, promote independent learning, and use ICTs as supportive learning aids.

Figures 5 and 6 also show that a greater percentage of private school students were in schools with strong commitment to transformative ICT uses. Private primary schools seemed especially committed to the use of ICTs for independent learning and as learning aids. A smaller percentage of public

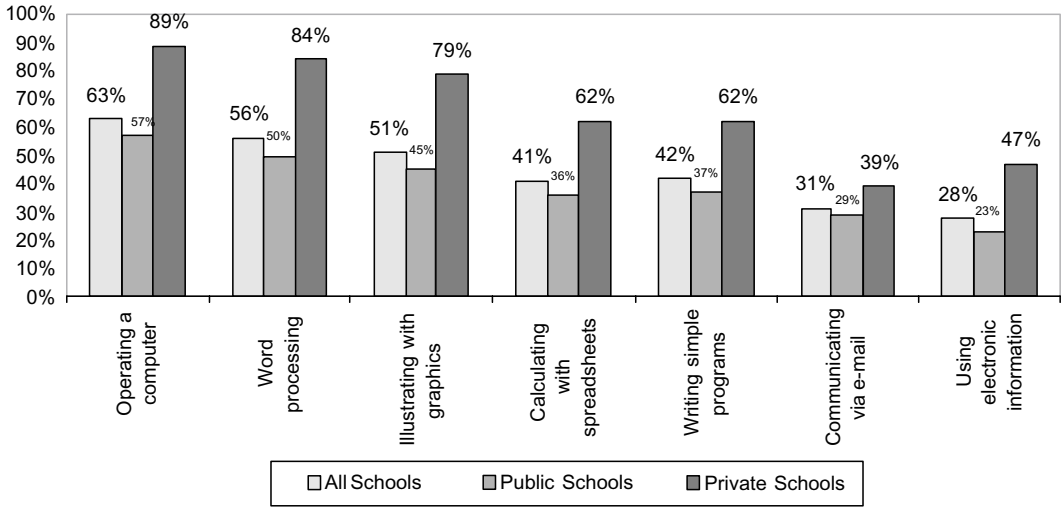

Fig. 7. Percent of primary school students whose principals indicated that students should have acquired certain ICT-related skills by the end of secondary school respectively.

school students had principals who cited the same policy goals. Computer hardware availability and Internet-related policy goals were not as prevalent in primary and secondary public schools as they were in private schools. This may be explained at least in part by public schools' lack of funds. When interviewed, several public school officials noted that their annual budgets were barely enough to pay for basic expenses such as electricity, water, and classroom materials. Hence, they regarded goals such as having one or more computers for every classroom or giving students individual e-mail accounts as not realistically attainable. Thus, emerging or transformative uses of ICTs were not realizable either.

11.1. Outcomes of learning about ICTs

Metro Manila schools use their ICT resources primarily to teach about computers. Principals representing the majority of primary school students from Metro Manila said they expected students to operate a computer (63%) and use a word processor (56%) before they finished grade school (Fig. 7). Some primary school students from Metro Manila were expected to use spreadsheets (41%) and write simple programs (42%) (Fig. 7). In one private elementary school, for example, students studied keyboarding in grade 4, Logo in grade 5, BASIC programming in grade 6, and HTML and productivity tools in grade 7.

When used in conjuction with academics, ICTs were generally employed as productivity tools. An activity that both public and private primary students regularly undertook was to use word processors for journal writing or to periodicals. One public elementary school, for example, required its students to write essays, sports articles, features, and editorials and then lay them out in the form of a newspaper.

Expectations vary depending on school ownership. While private primary school students within Metro Manila were required to acquire a variety of ICTs-related skills, including the ability to use the Internet, a smaller percentage of public primary school students were required to attain the same skills (Fig. 7).

The emphasis on computer-related skills continues at the secondary level. Both public and private school students were expected to learn how to operate a computer, use a word processor, illustrate using graphics, and calculate using spreadsheets (Fig. 8). Metro Manila secondary schools tended to prioritize

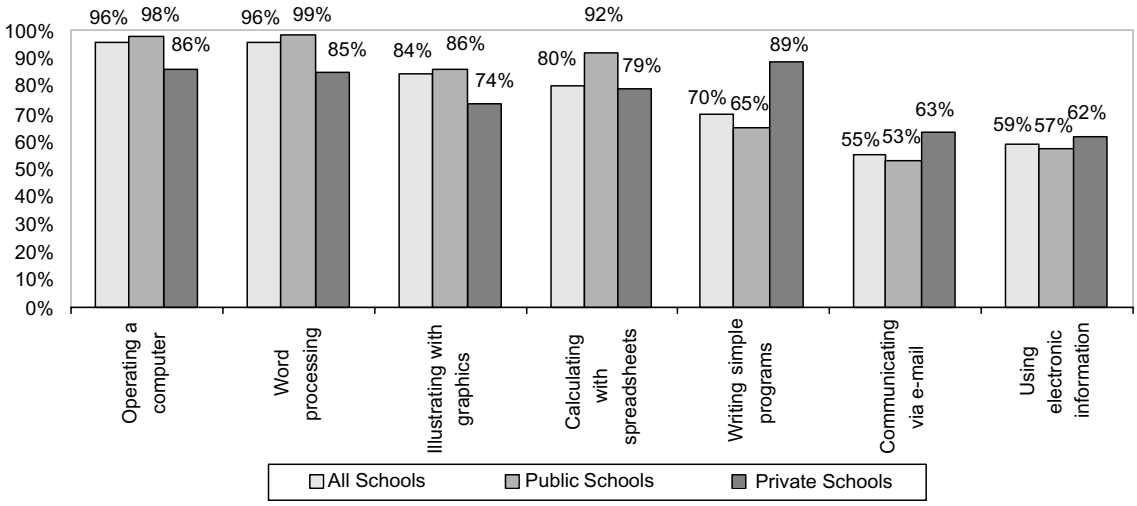

Fig. 8. Percent of secondary school students whose principals indicated that students should have acquired certain ICT-related skills by the end of secondary school respectively.

Internet-related skills. Approximately one-half of Metro Manila students were required to communicate via e-mail and use electronic information. A greater percentage of private rather than public school students came from schools with Internet-related goals, most probably because private schools were better equipped.

Programming was a goal among Metro Manila high schools, most especially those in the private sector. Seventy percent of secondary school students come from schools that required them to learn computer programming. Interview results offer at least two possible explanations behind Metro Manila schools' emphasis on computer literacy and programming. One interviewee noted that teachers generally lack the expertise to integrate ICTs in other subjects. She, herself, was asked to teach a mathematics class using mathematics software after only one day of training. Before that one-day session, she had no previous exposure to ICTs. Also, some schools hired external agencies or consultants to conduct ICTs classes. These agencies or people tended to be technology specialists, not educators. Hence, the emphasis of the training they provided was ICTs literacy.

11.2. ICTs-related learning opportunities

An issue related to schools' ICTs objectives is the opportunities schools offer students to learn with ICTs. These include opportunities to use ICTs applications, opportunities to use the Internet, and opportunities related to pedagogical practices.

Figure 9 shows that few Metro Manila primary school students had limited opportunities to use indicated applications. At most, some have exposure to word processing. Even among private primary schools, where students tended to have opportunities to use a greater variety of computer-based applications than public primary school students. However, the applications were generally limited to word processors, spreadsheets, CD-ROM-based encyclopedias, and programming languages (Fig. 9). These applications enabled students to learn about ICTs and also served as support or references for other subjects. On the other hand, only twelve percent or less of primary school students have exposure to simulation, mathematical modeling, and data manipulation software, technologies that support emerging or transformative ICT practices.

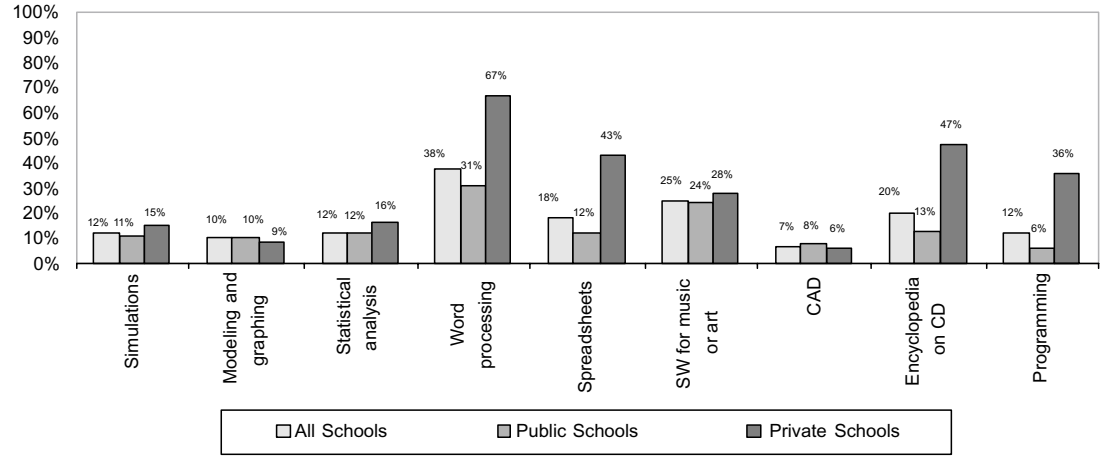

Fig. 9. Percent of primary school students whose technical respondents indicated that a typical student would have had opportunity to use particular ICTs applications by the end of primary school.

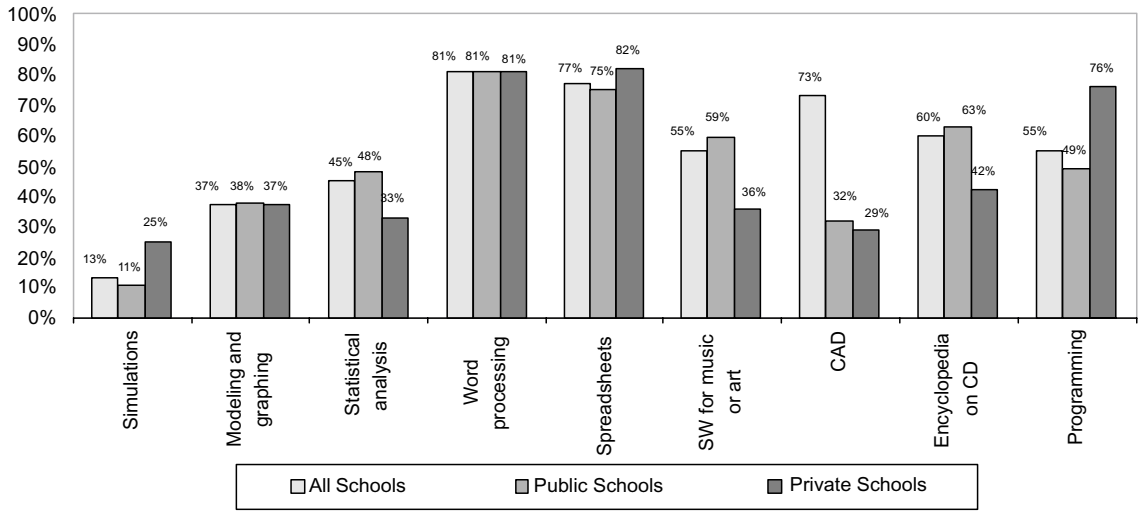

Fig. 10. Percent of secondary school students whose technical respondents indicated that a typical student would have had opportunity to use particular ICTs applications by the end of secondary school.

Secondary school students have greater opportunities to learn about and with ICTs. As shown in Fig. 10, Metro Manila secondary school students had opportunity to use word processors and spreadsheet applications. Simulation, mathematical modeling, and data manipulation software were less common.

Both public and private secondary schools gave their students opportunities for word processing and spreadsheet software (Fig. 10). A slightly greater percentage of public school students had access to CD-ROM-based encyclopedias and software for music or art. A greater percentage of private school students tended to have access to computer-based simulations and programming languages.

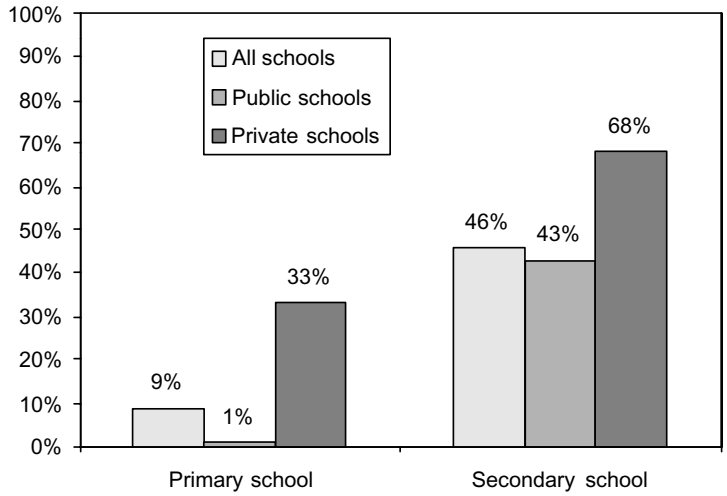

Fig. 11. Percentages of primary and secondary school students whose schools have internet access for teaching and learning.

11.3. Opportunities for Internet use

Metro Manila primary school students had limited opportunities to use the Internet. As shown in Fig. 11, Internet access is not pervasive in Metro Manila primary schools. Only 9% of primary school students are enrolled at schools with Internet access for instructional purposes.

Secondary school students have a greater level of Internet access. Technical respondents representing 46% of Metro Manila secondary school students said their schools had Internet access for instruction (Fig. 11). Most Metro Manila primary schools with e-mail and WWW access connected to Internet in 1998 or later. Metro Manila secondary schools, on the other hand, obtained Internet access as early as 1996.

Figure 11 shows that a greater percentage of private school students sampled have access to the WWW than their public school counterparts. Among private schools, 33% of primary school students and 68% of secondary school students had access to the WWW for teaching and learning. On the other hand, only 1% of public primary school students and 43% of public secondary school students have WWW access.

At the primary school level, opportunities to use the Internet were limited. Figure 12 shows that less than 10% of primary school students in Metro Manila use the identified Internet applications. Internet uses associated with emerging pedagogical practices such as using email for group projects, disseminating information using the WWW and videoconferencing were rare, even among private schools. Public primary schools, on the other hand, have such limited Internet access, that students were rarely able to engage in Internet-related activities of any kind.

Opportunities for Internet usage were most widespread at the secondary school level. Figure 13 shows that nearly half of secondary school students from Metro Manila used e-mail to communicate with teachers and peers. Thirty-seven percent of Metro Manila's secondary school students use the Internet for searching for information Technical respondents, representing up 45% of public school students, also indicated that their students had opportunities to perform a variety of emerging as well as supportive Internet-related activities (Fig. 13).

Private schools, on the other hand, tended to use the Internet to support other subject areas in traditional ways. The computer coordinator of one private secondary school told the researcher that Social Studies teachers used the Internet to teach students about Greek mythology. Teachers selected relevant Web

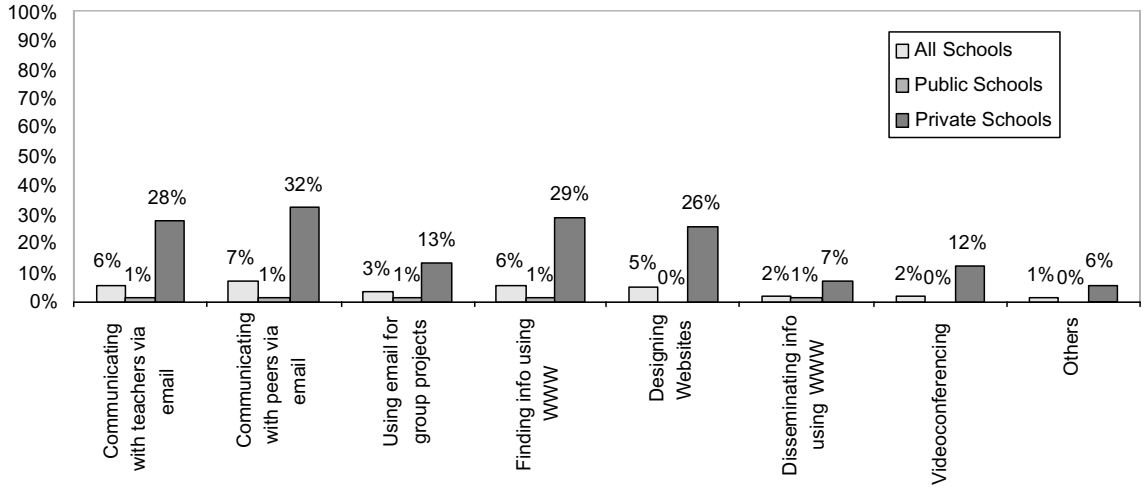

Fig. 12. Percentages of primary school students whose technical respondents indicated that typical students would have undertaken particular Internet / WWW activities.

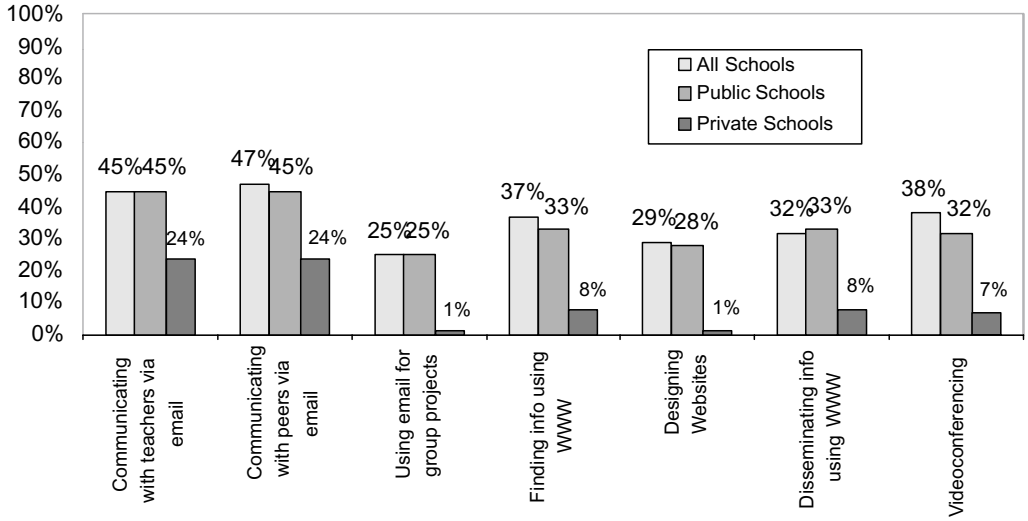

Fig. 13. Percentages of secondary school students whose technical respondents indicated that typical students would have undertaken particular Internet / WWW activities.

sites. The computer coordinator pre-loaded the pages onto the student computers. Then, during the Social Studies class, the students would browse through the pages offline.

Note that the public school percentages in Fig. 13 may be an overestimate of the situation in public secondary schools. The public school percentages were higher than the private school percentages because of the responses of one public school with a population of over 25,000 students. The technical respondent of that school reported that the school had 285 computers, 133 of which were connected to the Internet. This implied that there were over 180 students for every Internet-connected machine. While it may have been possible for the school to provide students with some Internet exposure given these circumstances, the researcher suspects that the exposure is limited and that if students of this school

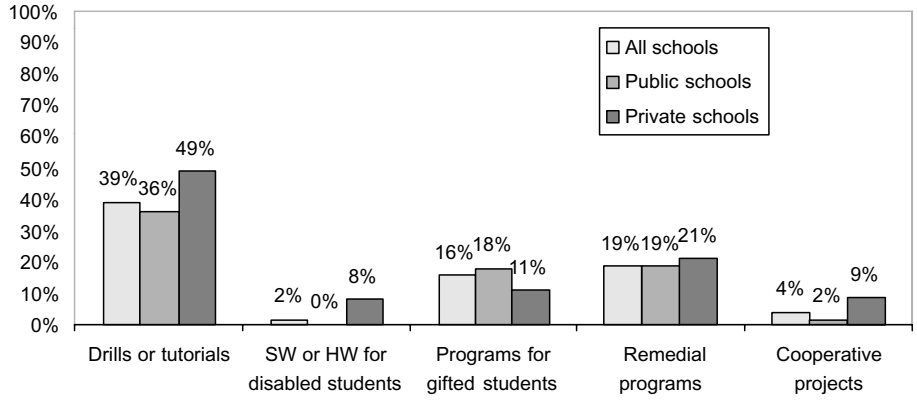

Fig. 14. Percent of primary school students whose principals responded that their schools engaged in the indicated pedagogical practices.

engaged in Internet-related activities, they probably did not do so on a regular basis.

11.4. Use of ICTs for other pedagogical practices

The researcher wanted to determine whether schools used ICTs to support emerging or non-traditional pedagogical practices. These included the use of special software for disabled students, the use of special programs for gifted students, and the use of electronic networks to encourage cooperative learning.

At both the primary and secondary school levels, schools tended to use drills or tutorials to improve student achievement in specific subject areas (Figs 14 and 15). This application is considered to be supportive of traditional modes of teaching. Special software and hardware for disabled students is practically not available for at any level.

Although private primary school students had greater opportunities to engage in computer-based drill-and practice and cooperative learning using ICTs than their public school counterparts (Fig. 14), there were are some exceptions, however. Several public elementary schools, with the assistance of outside agencies, used ICTs as part of an integrated approach to teaching. One public elementary school was using ICTs to teach English to a class of fourth grade students. At the time of the researcher's visit, the topic under study was St. Valentine's Day. Student groups were distributed throughout the classroom, each working on a different activity. One group searched through a CD-ROM-based encyclopedia for information on St. Valentine's Day. Another group searched for the same information using books. A third group made Valentine's cards from recycled materials. A fourth group wrote Valentine's poetry. The groups had a limited amount of time to finish their assigned tasks, after which they had to rotate.

On the other hand, at the secondary school level, public schools were more likely to use ICTs to improve learning, for gifted students, for remedial programs, and to engage in cooperative projects (Fig. 15). A smaller percentage of private secondary schools engaged in these activities.

12. Infrastructure

The availability of ICTs hardware and software and the extent of network connectivity are primary determinants of the quality and quantity of ICTs usage in schools. The following results give a general profile of the ICTs infrastructure available to students in Metro Manila schools and the degree to which they can support learning with computers.

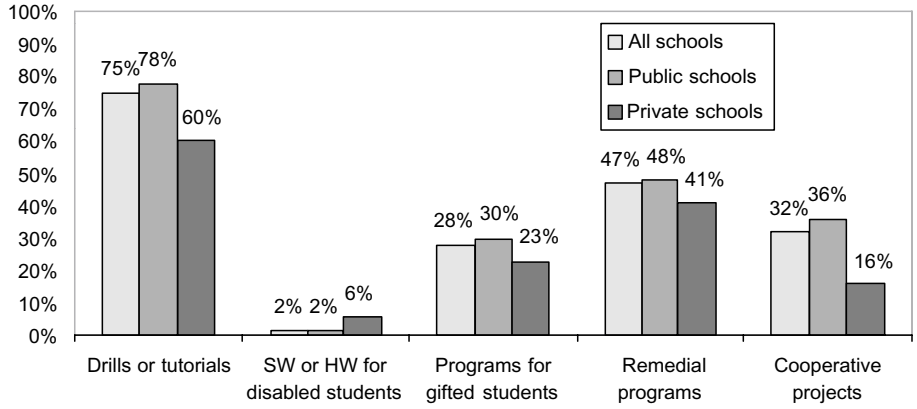

Fig. 15. Percent of secondary school students whose principals responded that their schools engaged in the indicated pedagogical practices.

Table 1
Student-computer ratios

School level	School ownership	A. Total students div by total computers	B. Total computer-using students div by total computers
Primary	All schools	92	25
	Public	346	48
	Private	23	19
Secondary	All schools	54	18
	Public	145	30
	Private	14	13

12.1. Hardware

A basic indicator of hardware availability in schools is the number of personal computers available for student use. Table 1 summarizes the student to computer ratios in primary and secondary schools. Note that a ratio of 10 indicates that there are 10 students for every computer. Also, the researcher used two ways of computing for the ratios. The ratios in the A columns represent the total number of students in all schools for the indicated grade level (whether computer using or not) divided by the total number of computers available to students at that grade level. The ratios in the B columns of the tables indicate the total number of computer-using students in the indicated grade levels divided by the total number of computers available to students at that grade level.

Primary school ratios indicate that Metro Manila primary school students have low access to computers. Private primary schools are better equipped than public primary schools. Table 1 shows that private primary and secondary students have more than twice as much access to computers as their public school counterparts. Private primary schools have 19 students for every computer, while public schools have a ratio of 48 to 1. Private secondary schools boast ratios of 13 to 1, while public secondary schools have as many as 30 students for computer.

At the secondary school level, Metro Manila students have better but limited access to computers. Even when schools have computers designated for student use (Table 3, Column B), the ratio is still 18 students to one computer.

Schools in Metro Manila still keep most of their ICTs resources in computer rooms. Figure 16 shows that, on average, 89% of primary school computers and 94% of secondary school computers are kept in

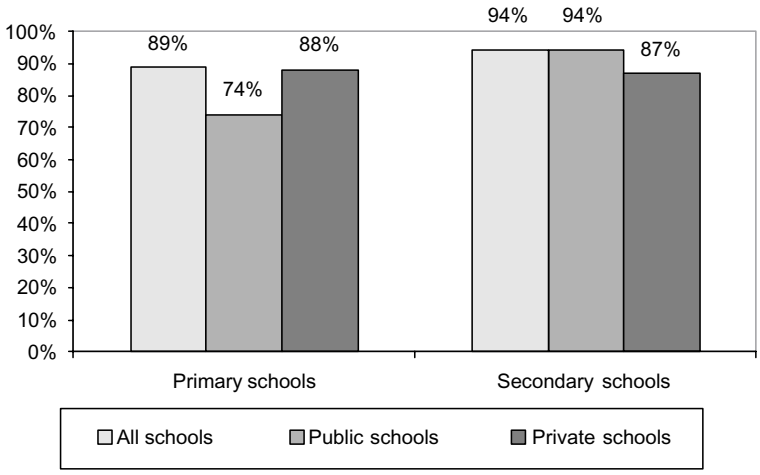

Fig. 16. Average percentages of computers in computer rooms in primary and secondary schools.

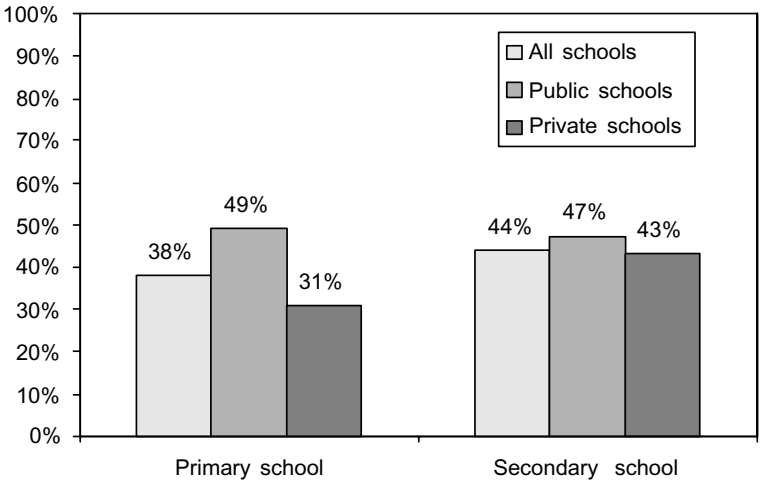

Fig. 17. Average percentages of multimedia computers in primary and secondary schools.

computer rooms or laboratories. This pattern was consistent regardless of school ownership (Fig. 16).

12.2. Multimedia

Whether school computers are capable of supporting multimedia or not has a great bearing on the types of applications schools can use for teaching and learning. Metro Manila students have limited access to multimedia computers. As shown in Fig. 17, only 40% of computers available to primary school students and 44% of secondary school students are multimedia-capable. Computers in public schools were more likely to have CD-ROM drives and sound cards than those in private schools. However, private schools had lower student to computer ratios than public schools. Therefore, a private school student was more likely to have access to a multimedia computer than a public school student, regardless of school level.

Aside from multimedia capability, processor types and operating systems are determinants of the types of applications computers can support. Figure 18 summarizes the average percentages of computers of

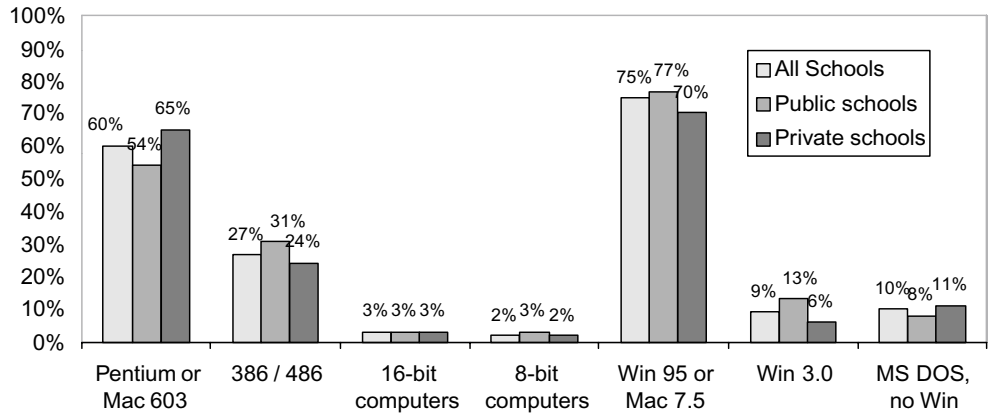

Fig. 18. Average percentages of computers of a processor and operating system type available to primary school students note. percentages do not total to 100% because of non-response.

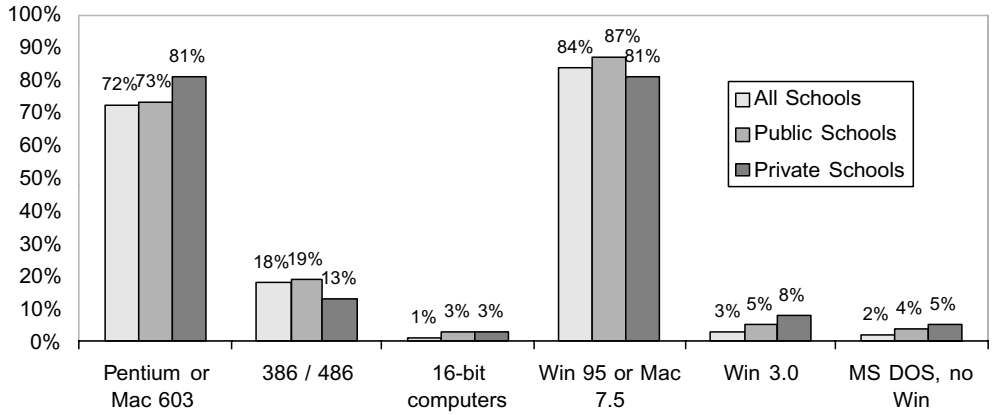

Fig. 19. Average percentages of computers of a processor and operating system type available to secondary school students. Note: Percentages do not total to 100% because of non-response.

specific processor types and operating systems. It shows that the computers available in Metro Manila primary schools are predominantly Intel Pentium-based (60%) running Windows 95, 98, or 2000 (75%). Figure 23 shows that computers in secondary schools are also predominantly Pentium-based (72%), running Windows 95, 98, or 2000 (84%).

Figures 18 and 19 show that the computers in public and private schools at the primary and secondary levels were predominantly Pentium-based. Public schools, though, tended to have a greater percentage of older (i.e. Intel 80386 or 80486-based) machines than private schools. The majority of computers in public and private schools at both levels used Windows 95 or higher.

The hardware and operating systems platform available in schools implies that school facilities are capable of supporting current multimedia learning materials. However, the high number of students per computer, especially in the public schools, limits students' opportunities to work with ICTs. Also, the placement of computers in computer laboratories generally dissuades non-ICT teachers from designing computer-based activities for their subject areas. This suggested that there was a mismatch between schools' goals nd schools' capabilities to realize these goals.

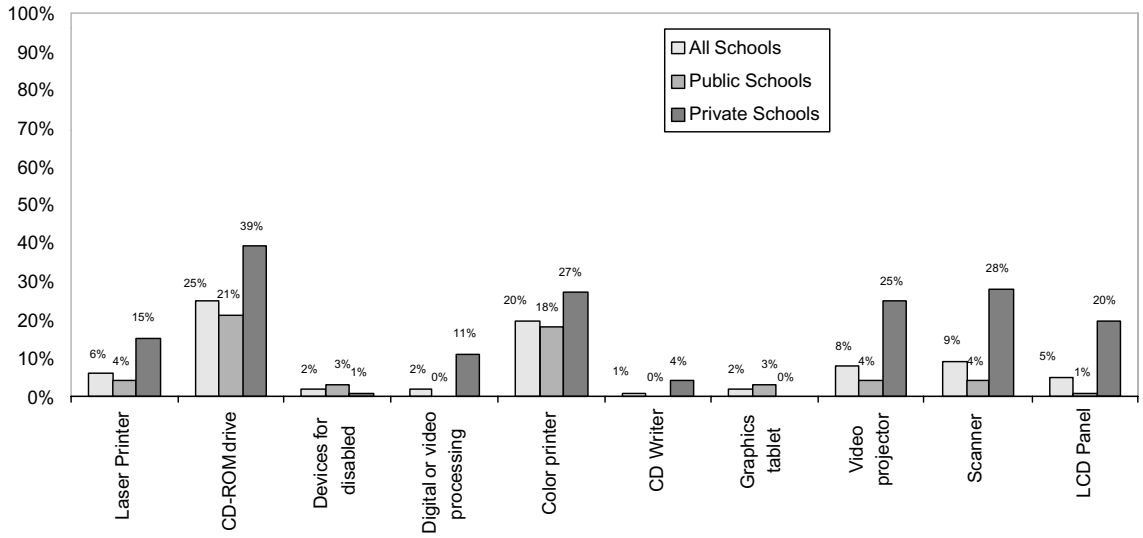

Fig. 20. Percentages of primary school students whose schools have specific peripherals.

12.3. Hardware peripherals

The degree of computer use in schools is determined, in part, by the types of hardware peripherals available for teaching and learning. As shown in Fig. 21, primary school students have limited access to peripherals. At best, schools are equipped with CD-ROM drives and color printers. Other types of peripherals are rare. Primary students from public schools have less access to other types of devices. Private schools tended to have a greater variety of peripherals than their public schools counterparts.

Technical respondents of over 80% of secondary school students said their schools had CD-ROM drives and color printers for instructional use (Fig. 22). A greater percentage of private secondary schools tended to have peripherals such as CD writers, video projectors, scanners, and LCD panels than public schools. In contrast, a greater percentage of public secondary schools tended to have laser printers, CD drives, and color printers.

Student access to these peripherals was limited. Table 2 shows the ratios of students to computers for primary and secondary schools in Metro Manila. The researcher computed column A values by dividing the total number of students for all schools (regardless of whether they had computers or not) by the number of printers available. The column B values were computed by dividing the total number of students from schools with computers by the total number of printers available. The table shows that, among schools with computers, there were 127 students for every printer. The table also shows that private school students at both primary and secondary levels had greater access to printers than public school students.

Because schools had few peripherals, schools restricted students' access to these devices. Follow-up interviews further revealed that both public and private school students needed teachers' or administrators' permission to use schools' colored printers and that teachers and administrators tended to grant permission only to students working on special school projects such as the school paper.

12.4. Software

The extent of ICTs use in schools is highly dependent on the types of software available to users. As seen in Figs 23a and 23b, 36 to 48% of primary school students are enrolled in schools with word

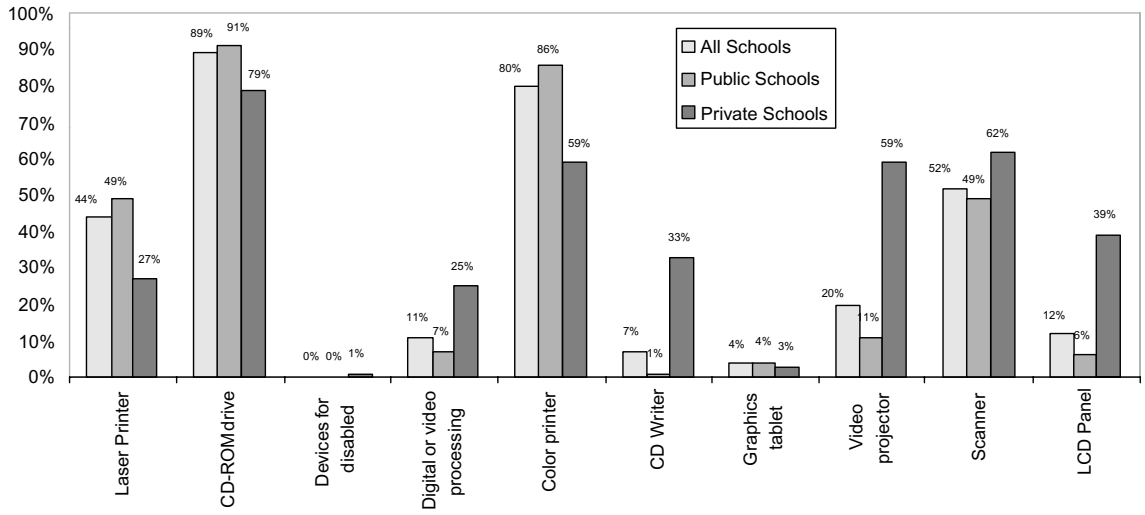

Fig. 21. Percentages of secondary school students whose schools have specific peripherals.

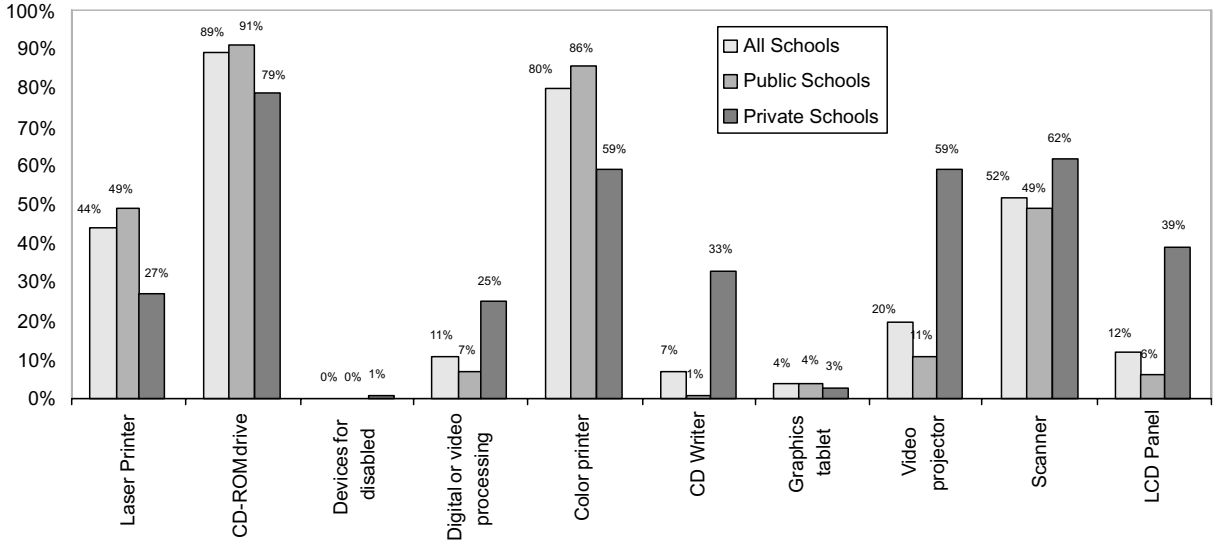

Fig. 22. Percentages of secondary school students whose schools have specific peripherals.

processing, spreadsheet, graphics, and presentation software. Upon interview, representatives of these schools referred specifically to the Microsoft® suite of applications. Primary school students also had access to educational and recreational games.

Figures 23a and 23b show that private primary schools tended to offer students greater exposure to a variety of software types. Technical respondents representing over 70% of private primary school students said that their schools had word processors, spreadsheet packages, graphics software, educational games, and presentation software for educational use.

As shown in Figs 24a and 24b, a high percentage of secondary school students have access to word processors (93%), spreadsheets (90%), and presentation software (85%). Once again, this is consistent

Table 2
Student to printer ratios

School level	Ownership	A. student to printer	B. Computer-using students to printer
Primary	All	465	127
	Public	1780	246
	Private	117	97
Secondary	All	339	115
	Public	1025	213
	Private	82	79

with the Microsoft® suite of productivity tools. Over one-half of these students used tutorials, drill and practice software, and educational games. Other types of software, particularly simulations, music composition, and software for microcomputer-based laboratories were not widely available at any school level.

At the secondary school level, both public and private school students have access to word processing, spreadsheet, database, graphics, and presentation software (Figs 24a and 24b). Greater percentages of private school students have exposure to programming languages and Internet-related software such as browsers and e-mail software.

Figures 23a, 23b, 24a, and 24b imply that students had the tools to learn about computers. They also had the tools to automate traditional teaching and learning processes and activities. In contrast, schools have limited software to support emerging or transformative ICT uses. As shown in Figs 25a and 25b, some primary school students had software for mathematics, English, and computer education. Software for the sciences, history, and civics was virtually non-existent.

Follow-up questions revealed that uses of available software tended to support traditional teaching practices. Public elementary schools with computers and some reference software sometimes asked their students to search for information. One public elementary school science teacher, for example, lectured briefly about the nervous system, presented students with several questions, and then asked them to search for the answers using a CD-ROM about the human body.

Figures 25a and 25b also show that private primary schools tend to possess software for a variety of subject areas, particularly English, mathematics, and computer education. The software that was available in public elementary schools was generally limited to the subject areas of English and mathematics.

The software available to secondary students in Metro Manila was largely limited to the subject areas of mathematics, science, and English (Figs 26a and 26b). Schools had limited software for learning the national language, Filipino. Indeed, when the researcher asked school officials what software they were using to teach Filipino, some respondents answered "Microsoft® Word." These respondents then clarified that it was used predominantly for typing out Filipino compositions. Metro Manila schools, both primary and secondary, also had little software available for civics. Upon being interviewed, some respondents asked, "Is such software available at all?"

Secondary school students were likely to have access to software for computer education. This implied that schools tended to use ICTs to teach computer literacy. Students studied ICTs as subject, rather than as tools to learn other subjects. The ICTs curriculum of one private secondary school required students to learn keyboarding, word processing, spreadsheet, database, and presentation software skills over four years.

Among secondary schools, a greater percentage of public schools tended to have software for a variety of subject areas (Figs 26a and 26b). Private schools trailed public schools in ownership of software for mathematics, science, English, history, and geography and other subject areas. Software for computer education was available in both public and private secondary schools.

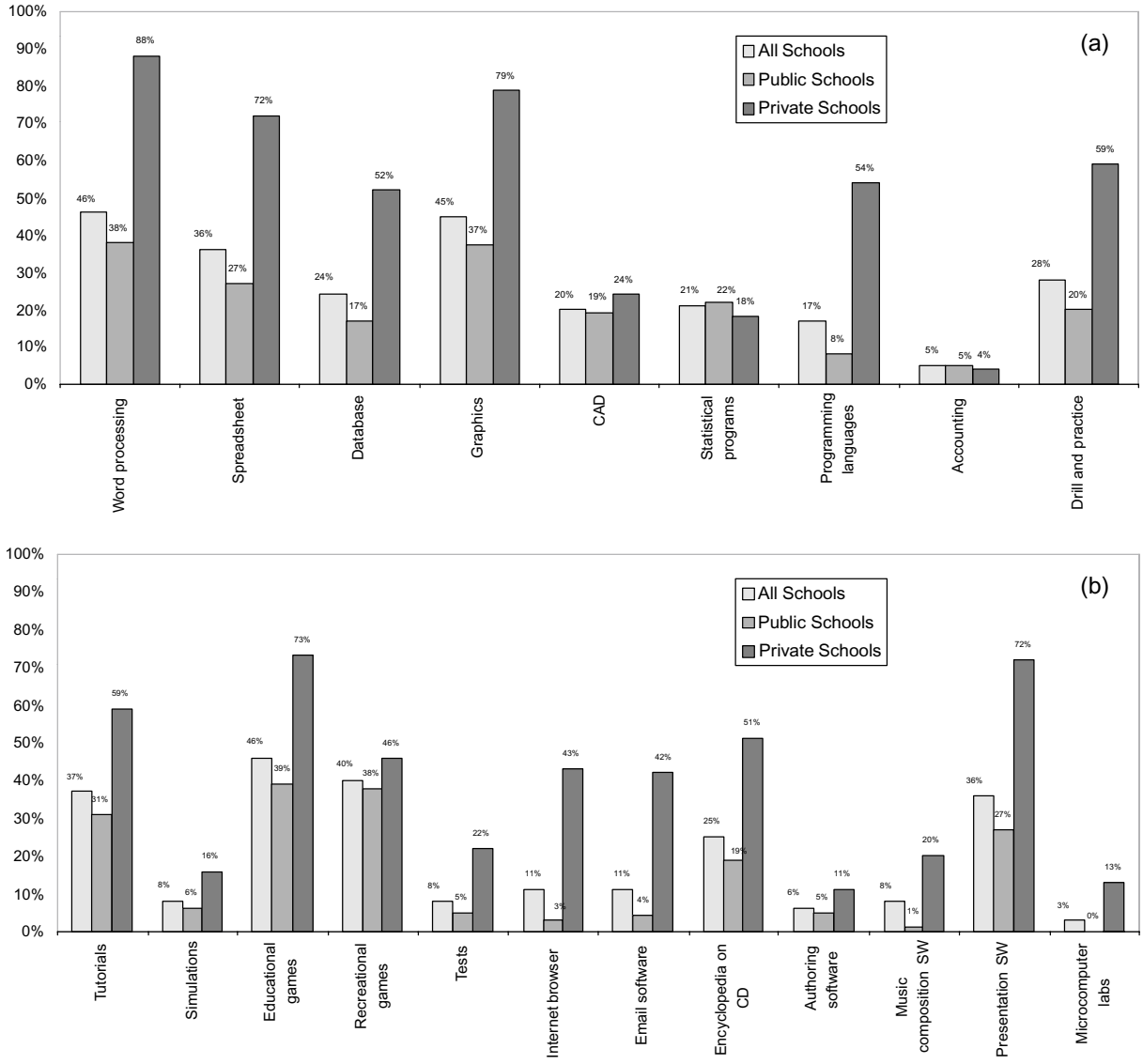

Fig. 23. Percentages of primary school students whose schools had specific types of software for instructional use.

13. Conclusions

The data collected during this study enabled the researcher to answer the research questions she posed at the beginning of the study. At the primary school level, emerging uses of ICTs were not a high priority. Respondents representing less than half of primary school students regarded the encouragement of active learning strategies, individualized learning experiences or independent learning as very important. Respondents representing about half of primary schools students said that their schools used ICTs to as learning aids and to encourage independent learning. More private school rather than public school respondents tended to value emerging uses of ICTs.

At the secondary school level, emerging uses of ICTs were regarded as very important. Principals

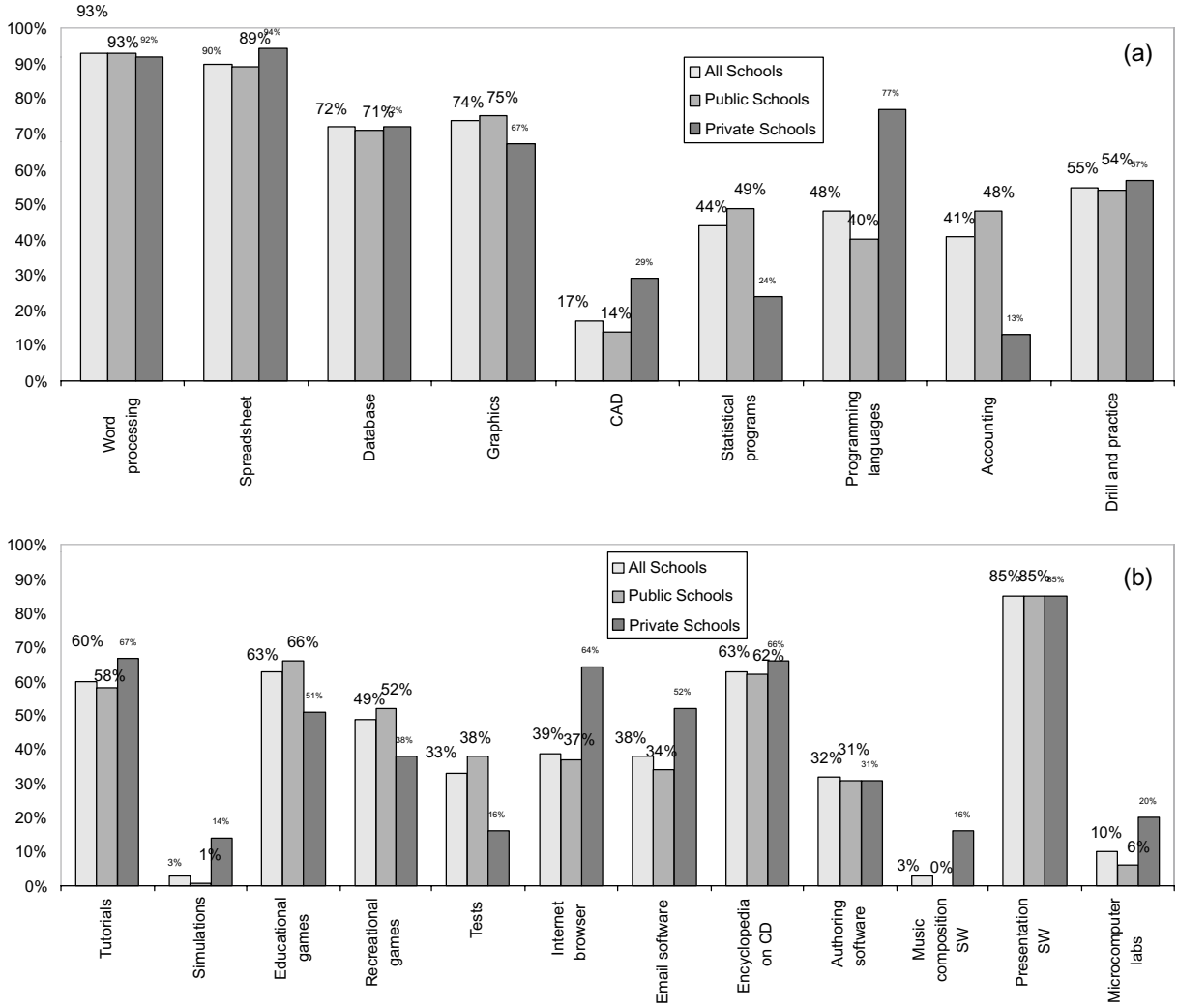

Fig. 24. Percentage of secondary school students whose schools had specific types of software for instructional use.

representing the majority of secondary school students stated that among their goals for using ICTs were the promotion of active learning and independent learning. Private schools tended to be more committed to Internet-based learning goals than public schools.

Actual learning outcomes at both levels of education, however, tended to be centered on the acquisition of computer skills. Both primary and secondary schools expected students to master basic computer operations and become fluent in the use of productivity tools. Word processors and spreadsheets were available at the primary school level and even more available at the secondary school level. Secondary schools put a premium on computer programming. These outcomes fall short of the transformative or emerging goals that some principals articulated.

The limitations on ICT use were attributable to schools' lack of resources. ICT infusions provided schools with multimedia-capable computers and current operating systems. However, student-to-computer and student-to-peripheral ratios were still high. Furthermore, Metro Manila schools also tended to keep their computers in computer rooms or laboratories. Non-ICTs-subject area teachers were

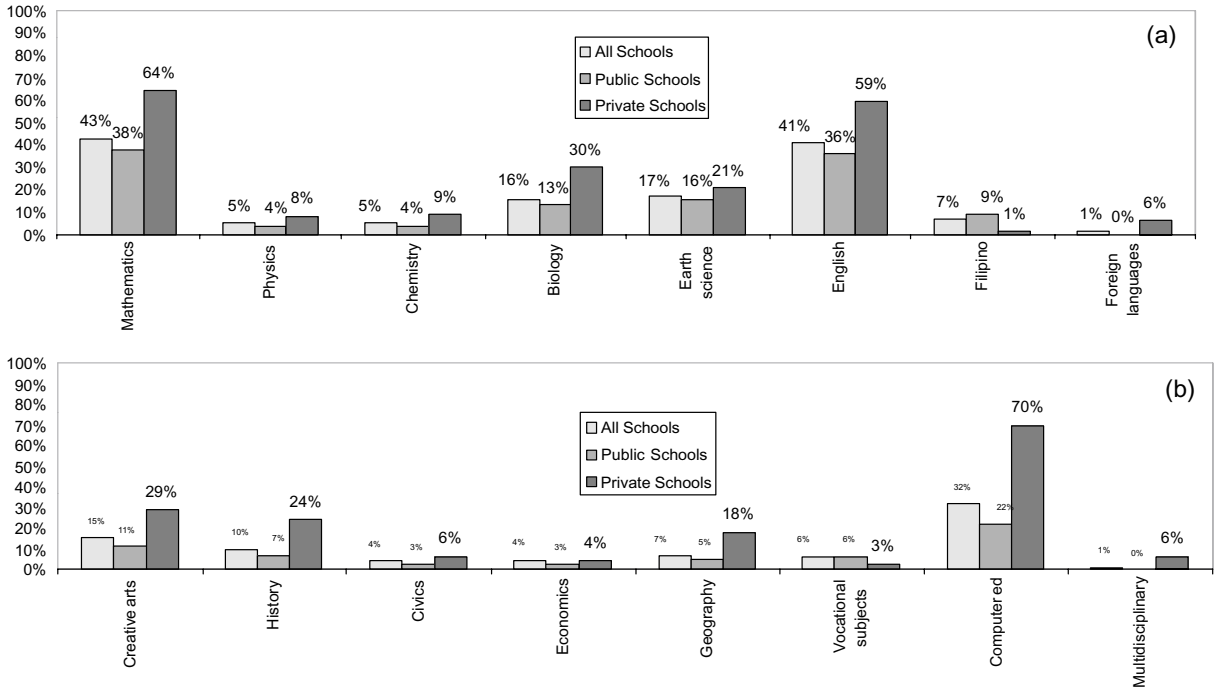

Fig. 25. Percentage of primary school students whose schools possessed software for specific subject areas.

therefore less likely to use them for instructional purposes. This implies that, in Metro Manila students generally had use of ICTs only during a "computer class" where the subject matter to be taught is computer-related. As such, any outcomes from ICT exposure would be computer-related as well.

The percentage of secondary school students that had software for computer education was high. When students had occasion to learn with computers, available software also limited the activities they could perform. In support of the traditional mode of instruction, primary and secondary schools used computers for drill and practice. There were few opportunities to learn with simulations or modeling software. Private primary schools tended to have software for math and English. Public primary schools had little subject-specific software. At the secondary level, respondents representing one half of students said their schools had software for the sciences. Few had software for the other areas.

Finally, at the primary school level, opportunities to use the Internet were limited, with public primary school students having virtually no Internet access. Internet access improved at the secondary school level. When available, the Internet was predominantly used for email.

In the case of Metro Manila and the Philippines at large, ICTs remain at the periphery of the teaching-learning process, automating the traditional instead of striving for the emerging. The data from this study substantiates Cuban's [4] view that ICTs are still far from achieving deep and comprehensive changes in teaching and learning.

14. Recommendations

Despite ICTs limited usage and effects, educators and policy-makers must continue to supply schools with technology. Availability of and exposure to ICTs has to reach a critical mass before schools can make transformative use of these resources. At present, this level has not yet been reached.

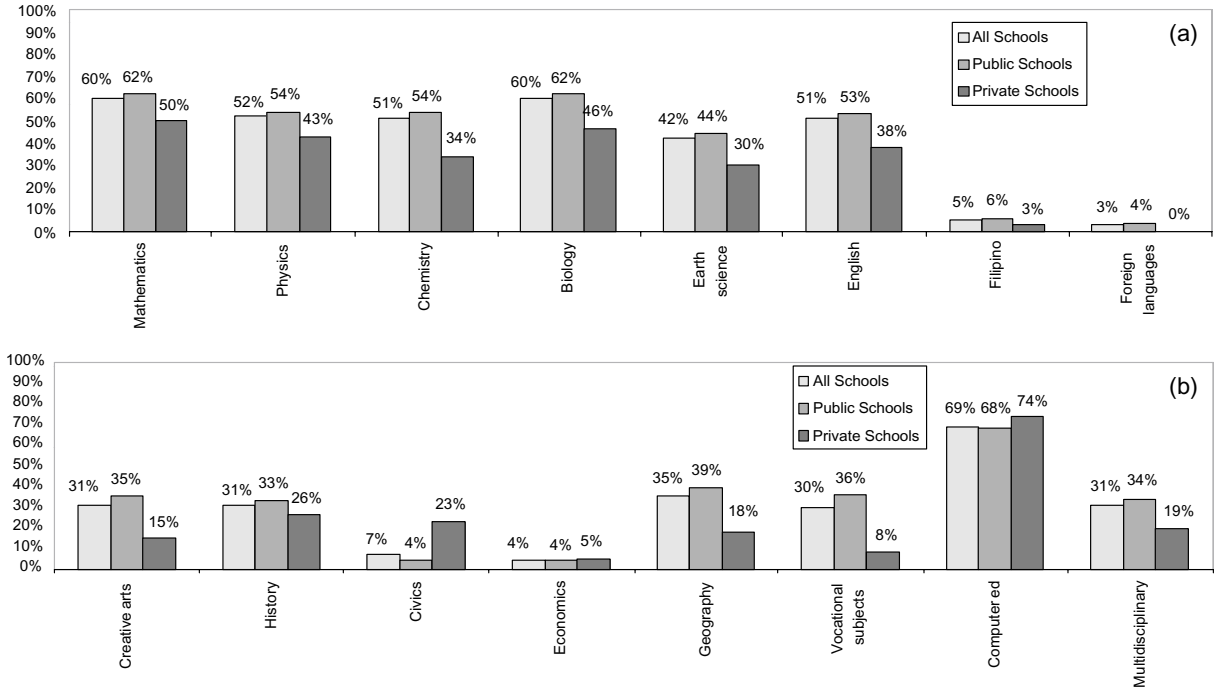

Fig. 26. Percentages of secondary students whose schools possessed software for specific subject areas.

Public schools in particular need to catch up with their private school counterparts. To do so, public schools should continue to partner with external agencies and local communities to acquire more equipment.

Educators and policy-makers should also continue to provide public and private school teachers with further training beyond basic computer literacy training. Teachers should be able to identify opportunities for technology intervention, to find and make use of appropriate technology when the opportunity arises, and to evaluate the outcomes of the intervention.

Finally, curricular goals should no longer include the development of computer-related skills as ends in themselves. Rather, educational goals should advocate the integration of ICTs in other subject areas, in order to improve student motivation and achievement.

15. Suggestions for further study

The researcher views her study as a starting point for further research. Many aspects of this study are open to extension or investigation. As mentioned in the Implications subsection, the survey may be repeated with changes in methodology to increase response rate. If the survey results are going to be compared with those from other countries, the survey may be repeated following the sampling methodology used to conduct the comparative survey. A survey of a national scope would also yield interesting and valuable results.

It would be interesting to compile longitudinal data on ICTs usage in Metro Manila schools. Some of the schools surveyed for this study, for example, indicated that they were acquiring Internet access within the 2001–2002 school year. It would be interesting to see what percentage of schools was able to reach this goal and what effect it had (if any) on ICTs goals, practices, and actual usage.

Some of the problems outlined by this study lend themselves to further investigation. The researcher pointed out an existing gap between schools' curricular goals and actual ICTs usage. Schools aspire to use ICTs for improvements in pedagogy and student achievement, but actually limit ICTs-related instruction to computer literacy and programming. It would be interesting to quantify this gap and to determine what can be done to bridge it. Results from a study of this nature could help guide teacher training, curricular reform, and ICTs-related spending.

The schools with little to no access to ICTs also merit further investigation. It would be interesting to determine why these schools are marginalized. Do government or private sector policies disenfranchise them? Do they have problems with infrastructure (buildings, electricity, and telecommunications)? The results from such a study can help determine which schools are underserved and may help direct funding from the public or private sector.

Finally, the researcher perceives a need for educational software for Filipino-specific subjects such as the Filipino language and civics. There is a dearth of instructional software to support Filipino culture and curriculum. Instructional software development for these areas may be undertaken as research projects or perhaps even subsidized commercial endeavors.

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